

December 8, 2005

Mr. David Snyder, Executive Director
South Dakota Science and Technology Authority
P.O. Box 8329
Rapid City, South Dakota 57709

RE: Letter of Interest for the Homestake Deep Underground Science and Engineering Laboratory

Dear Mr. Snyder:

As an alumnus of the South Dakota School of Mines & Technology I am very happy that the Homestake Mine will, once again, be available for research and education. As you know, the Homestake Mine has a long history of innovative engineering research and development of new underground mining methods and gold processing techniques, and is well known for the excellence of its geological department and their attention to the details of the complex ore bodies. My Ph.D. thesis, at the University of California, Berkeley, was on *Wall Rock Alteration and the Localization of Gold in the Homestake Mine*.

There are two projects that I would like to pursue at the Homestake DUSEL:

1. Development of a Hard Rock Underground Mine Mapping and Surveying Teaching Laboratory. Access to hard rock, underground mines for instructional purposes is very limited. While operating mines are always willing to accommodate student tours, providing access to workings that are suitable for instruction for several days at a time requires a significant commitment on the part of the mine operator that few, if any, are staffed and budgeted to undertake. Use of recently abandoned mine workings for instruction is costly for the instructional institution, because of the cost of maintaining ground support and ventilation and other safety issues. The need to continue training of underground mine geologists and engineers in mapping and surveying is recognized by both the Society of Economic Geologists and the Society for Mining, Metallurgy, and Exploration. The 4850-Level of the Homestake Mine has the potential for the establishment of a permanent hard rock, underground mine mapping and surveying teaching laboratory, but until it is available for on-site inspection, it is impossible to be more specific than that. While the initial development of the laboratory would, conceivably, be done as a collaborative venture between Montana Tech and South Dakota School of Mines & Technology, once established the laboratory would be available for instruction to all interested institutions of higher education in the United States.

2. Investigation of the Partitioning of CO₂ and H₂O, gold, and trace metals between synformal and antiformal fold hinges in the Homestake (iron) formation in the Homestake Mine, Lead, South Dakota (with Professors Christopher H. Gammons and Colleen Elliott, Geological Engineering Department, Montana Tech). It has been recognized for several decades that, with the exception of the Main Ledge, the gold ore bodies of the Homestake Mine are localized in the hinges of synformal folds (Slaughter, 1968), while the hinges of the antiforms are barren. Although not well documented, the metamorphic mineral, cummingtonite, appears to be preferentially developed in iron-formation in the hinges of antiformal folds throughout the northern Black Hills, while original iron-carbonate minerals persist in the hinges of the synforms (R. W. Bayley, 1972, personal communication). This relationship between cummingtonite and iron-carbonate in rocks metamorphosed to garnet-grade suggests that partitioning of a CO₂-rich and a H₂O-rich metamorphic fluid may have played an important, early role in the gold ore-forming process. Rye and Rye (1974) reported fluid inclusions of two types in the 11 Ledge ore-body, one with liquid water and gaseous CO₂, the other containing liquid water, liquid CO₂, and CO₂ gas. This investigation will require access to the Homestake Mine Drill-Core Achieve, as well as the mine's geology and mine records. A limited number of samples from selected drill-core will need to be taken for fluid inclusion studies and geochemical analysis. Access to mine workings for sampling and mapping may, also, be necessary. Additional collaborators will be sought, once the extent of the Drill- Core Achieve and mine workings access is established.

I will be happy to answer any questions that you, or others, may have regarding these proposals. My office phone is (406)496-4353 and my email is dwolfgram@mtech.edu

Sincerely,

Diane Wolfgram, PhD, RG
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